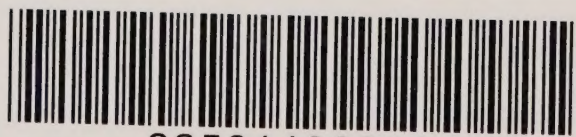


HORMONES





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Introduction

THIS booklet gives a brief account of the hormones secreted by the ductless glands, and only the more important ductless glands and their hormones are considered. The anti-diabetic hormone insulin is discussed in the booklet entitled *Chemotherapy*, and at the end of the booklet will be found a list of the principal hormone preparations available in this country.

More detailed information on the hormones mentioned will gladly be sent on request to:—

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HORMONES



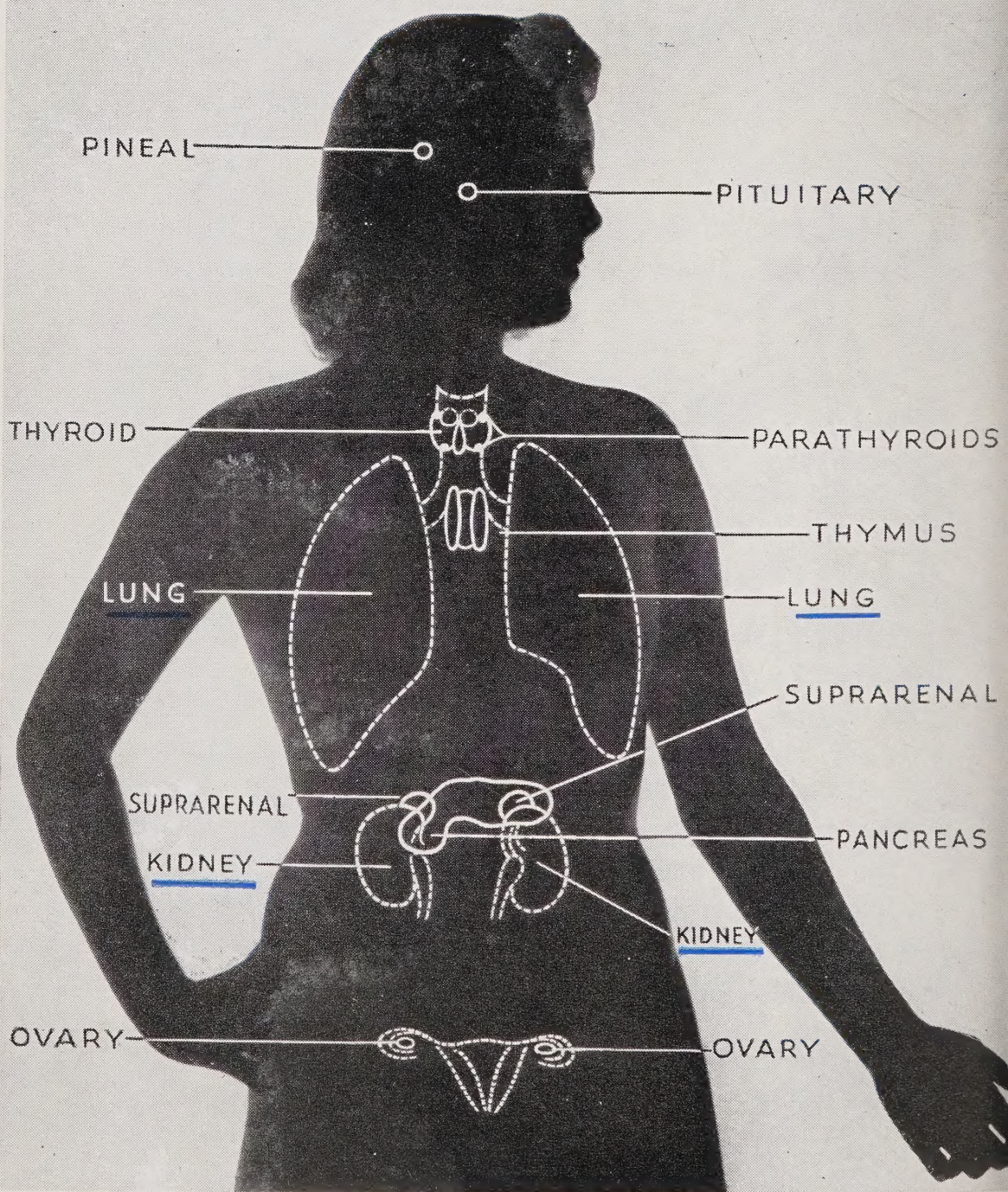
HORMONES are chemical substances secreted by ductless glands and are essential for the proper functioning of the body.

The term 'hormone' (from the Greek 'hormōn') means rousing or setting in motion, and the glands concerned are called endocrine glands. The specific hormones of these glands are secreted directly into the blood-stream and affect organs which are some distance from the secreting glands. They also influence other endocrine glands.

Although the effects of the removal of the ductless glands have been known for centuries, it is only during the last fifty years that our knowledge of their actions has been placed on a scientific basis. In the early days, the powdered glands of animals were given for all sorts of conditions, but it is now known that most of their activity must have been destroyed in the stomach and such preparations have been largely superseded, either by standardized glandular extracts or by synthetic substances which can be manufactured in the laboratory and have a similar physiological action.

The position of the principal ductless glands in the body will be seen from the following diagram :—

POSITION OF DUCTLESS GLANDS IN THE BODY



Pineal

Little is known regarding the function of the pineal gland. It may have some effect on growth and general development, but no specific hormone has been isolated from the gland.

Pituitary

The pituitary is situated in a most impregnable position at the base of the brain and has most important functions to fulfil. The posterior lobe produces oxytocic and pressor principles, whilst the anterior lobe secretes no less than nine different hormonal substances.

Thyroid

The thyroid glands are situated in the neck on either side of the trachea or windpipe.

Parathyroids

Small glands situated on the under-surface of the thyroid.

Thymus

The thymus—in the thorax—is known to influence growth during childhood, but its function in adult life is obscure.

Suprarenal (Adrenal)

The suprarenal or adrenal glands are triangular bodies resting upon the upper borders of the kidneys. They produce two hormones—one in the cortex or outer layer, and one in the medulla or inner layer.

Pancreas

The pancreas, in addition to producing enzymes necessary for digestion, secretes insulin which is essential in the metabolism of carbohydrates and fats.

Ovaries and Testes

The ovaries in the female and the testes in the male produce hormones which are closely related chemically ; they have been isolated and also prepared synthetically in the laboratory.

The following table gives the principal functions of the ductless glands in health and disease :—

FUNCTIONS OF THE DUCTLESS GLANDS IN HEALTH AND DISEASE

<i>Name</i>	<i>Active Principle</i>	<i>Functions</i>	<i>Diseases associated with—</i>	
			<i>Decreased Activity</i>	<i>Increased Activity</i>
Pineal ..	Unknown	May have some effect on growth and general development in children	?	?
Pituitary				
(a) Anterior ..	Unknown	Controls growth and influences all sex functions	Dwarfism ; sex infantilism ; amenorrhoea ; impotence	Gigantism in children ; acromegaly in adults ; Cushing's disease
(b) Posterior ..	Pressor and oxytocic principles	Controls uterine contractions and diuresis	Diabetes insipidus	Possible emaciation and gastro-intestinal disorders
Thyroid ..	Thyroxine	Regulates the production of energy and controls physical and mental development	Myxoedema ; cretinism in children	Thyrotoxicosis
Parathyroid ..	Parathormone	Influences phosphorus and calcium metabolism and bone formation	Tetany which causes nervous disturbances	Bone deformities
Thymus ..	Unknown	Influences growth during childhood	Uncertain	Uncertain

FUNCTIONS OF THE DUCTLESS GLANDS IN HEALTH AND DISEASE—cont.

<i>Name</i>	<i>Active Principle</i>	<i>Functions</i>	<i>Diseases associated with—</i>	
			<i>Decreased Activity</i>	<i>Increased Activity</i>
Pancreas ..	Insulin	Controls level of blood sugar	Diabetes mellitus	Hypoglycaemia
Suprarenal (a) Cortex ..	Deoxycorticosterone	Essential to life; exact function uncertain	Addison's disease	Sexual precocity and virilism
	Adrenaline	Regulates energy output in emergencies	Uncertain; may produce lowered blood pressure	Probably produces paroxysmal hypertension
Ovary ..	Oestradiol and Progesterone	Control secondary sex characteristics in the female	Amenorrhoea; atrophy of secondary sex organs; psychological disturbances; menopausal symptoms	Probably has little effect apart from menstrual disturbances
Testis ..	Testosterone	Controls secondary sex characteristics in the male	Atrophy of secondary sex organs; psychological disturbances	Uncertain; possibly some degree of 'hypermasculinity'

The Adrenal or Suprarenal Glands

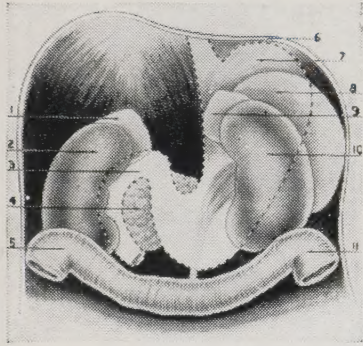
In 1855, Thomas Addison showed that the disease now known as Addison's disease, which should not be confused with Addisonian anaemia (pernicious anaemia), was associated with degeneration of the adrenals, and in 1856 the celebrated French doctor, Brown Séquard, showed that the experimental removal of the glands caused death. Oliver and Schäfer, in 1895, found that the injection of extracts from the adrenal medulla produced a marked rise in blood pressure, their experiments initiated intensive pharmacological investigations which led to the isolation of adrenaline by Aldrich and Takamin, and its synthesis by Stolz in 1904. Adrenaline was the first hormone to be isolated in crystalline form and to be produced synthetically.

Adrenaline has been called the 'emergency' hormone as it is secreted in increased amounts in times of stress or strain and enables the body to perform tasks which sometimes seem impossible. That these effects are due to the influence of the hormone of the adrenal glands has been shown by injecting solutions of adrenaline into animals, when similar effects are produced.

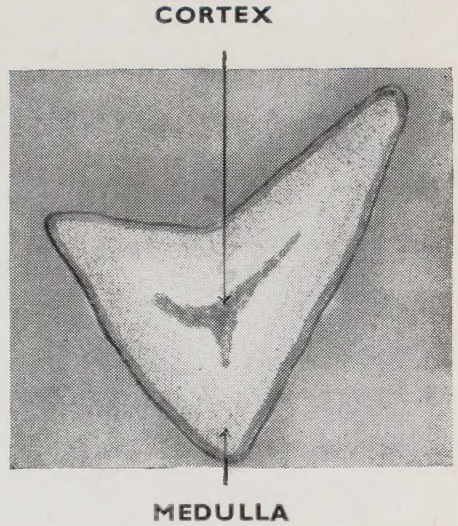
Adrenaline causes the superficial blood-vessels to contract, increases the blood-pressure, and stimulates carbohydrate mobilization from the liver. It is obtained either from the adrenal glands or synthetically, and is used in the form of a 1-1,000 solution to stimulate the heart and produce a vaso-constricting action, and to localize the action of anaesthetics. It is most valuable for the treatment of asthma. The absorption of adrenaline after injection is very rapid, and various attempts have been made to prolong its action. Oily suspensions have been employed, but the adrenaline is rapidly oxidized. Recently, adrenaline associated with ascorbic acid which considerably retards oxidation, has been used in the form of a suspension and found to be most beneficial in the treatment of chronic bronchial asthma.

The cortex or outer portion of the adrenal gland is known to be essential to life, but apart from the fact that it controls sodium metabolism, its exact function is unknown. Addison's disease is due to an insufficiency of adrenal cortical hormone. In the absence of specific treatment, 40 per cent. of patients die

ADRENAL GLANDS



THE
ADRENAL
GLANDS
ARE
SITUATED
ON THE
TOP OF
EACH
KIDNEY



POSITION OF THE ADRENAL GLANDS

1. Right Adrenal Gland
2. Kidney
3. Duodenum
4. Pancreas
5. Right Colic Flexure
6. Diaphragm
7. Stomach
8. Spleen
9. Left Adrenal Gland
10. Kidney
11. Left Colic Flexure

MEDULLA-CORTEX

Produces **Adrenaline** which is
used in the treatment of . . .

- SHOCK
- COLLAPSE
- ASTHMA
- CERTAIN SKIN
CONDITIONS

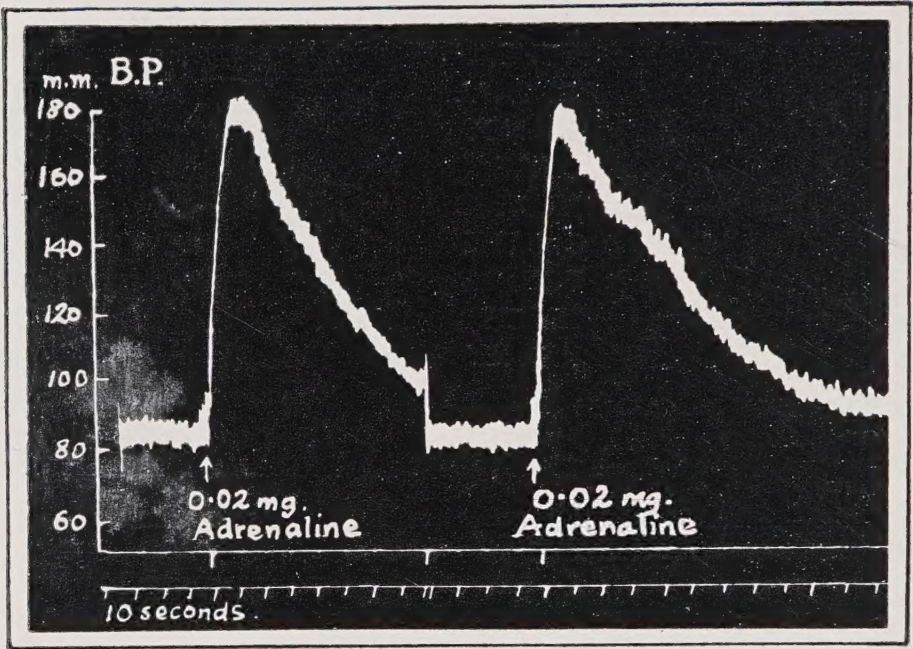
Controls . . .

- MUSCLE EFFICIENCY
- KIDNEY ACTION
- DISTRIBUTION OF
WATER AND SALT
IN THE BODY

.....

Extract of Adrenal Cortex is
now used in the treatment of
progressive wasting disease
which results from failure of
the Adrenal Cortex.

PHYSIOLOGICAL ACTION OF ADRENALINE



EFFECT ON RABBIT'S BLOOD PRESSURE

within a year, and few survive more than a few years. Of the several crystalline compounds which have been isolated from the gland, Kendall, in 1937, found corticosterone and dehydrocorticosterone to be most active. More recently, a synthetic product called deoxycorticosterone has been prepared, and although it has not exactly the same action as natural extracts prepared from the adrenal gland, it has largely replaced them in the treatment of Addison's disease. Synthetic deoxycorticosterone was shown to be considerably more active than the natural hormones which had been isolated, and in 1938, Richstein found that the adrenal glands also produced deoxycorticosterone. This is of interest, as it is an example of a highly potent synthetic substance being produced in the laboratory before it had been isolated from the gland in the body.

There is a close interrelationship between the adrenal glands and the pituitary. Cushing's syndrome, which is characterised by adiposity affecting the face, neck, and trunk, associated with hypertension and with virilism, may be caused by either abnormal adrenal or pituitary glands.

The Thyroid Gland

The importance of the thyroid gland was not realised until the latter part of the last century, although it was known that iodine was effective in the treatment of simple goitre, and enlargement of the gland was sometimes due to an iodine deficiency in the diet.

In the past, opinions reported regarding the function of the thyroid gland have been as varied as they have been ingenious. Wharton, for instance, in 1656, thought that the viscous fluid in the gland, which we now know to be iodothyroglobulin, acted as a lubricant for the windpipe. He also stated that the thyroid contributed much to the rotundity and beauty of the neck, filling up the vacant space round the larynx and making its protuberant parts almost to subside and become smooth, particularly in females to whom, for this reason, a large gland has been assigned which renders their necks even more beautiful. Rush stated in 1820 that he thought "the thyroid necessary to guard the female system from the influence of the more numerous causes of irritation and vexation to which they are exposed than the male sex".

Two Swiss surgeons removed the entire gland in cases of goitre, and its removal caused alarming symptoms, the patients becoming apathetic and losing all initiative. Obviously, they had been deprived of something secreted by the thyroid which was essential to health. Similar effects were produced in animals.

Murray, in 1891, was the first to administer thyroid to a patient, and Bouman, in 1896, showed that the thyroid contained iodine in organic combination. Three iodine compounds have been isolated from the gland; iodothyroglobin, diiodotyrosine, and thyroxine. It is considered that thyroxine is synthesized in the body from the amino acid tyrosine which first combines with iodine to form diiodotyrosine, an inactive compound, and this condenses to give thyroxine.

In 1927, Harrington and Barger synthesized thyroxine in the laboratory, and as this substance was the only one known to produce the same response as dried thyroid, it was concluded to be the essential hormone of the gland. Many attempts have been made to prepare iodinated proteins such as iodinated casein, but recent work has shown that the activity of these compounds is due to the presence of thyroxine, thus confirming that it is the active principle of the thyroid gland.

THYROID GLAND

THE THYROID GLAND

produces the chemical substance, thyroxine, which controls the rate at which the body burns up its fuel.

UNDER-ACTIVE GLAND

Body machine running in low gear

Mentally and Bodily Retarded

CURED BY REGULAR DOSES OF THYROID EXTRACT

Weight increase, mental slowness, hair becomes dry and falls out, skin becomes thick and dry, eyelids puffy

OVER-ACTIVE GLAND

Body machine running in top gear — over-heated—burning out

Loss in weight, nervous and irritable, over-active, protruding eyeballs

IN CHILDREN

—causes CRETINISM



Before treatment



After treatment

IN ADULTS

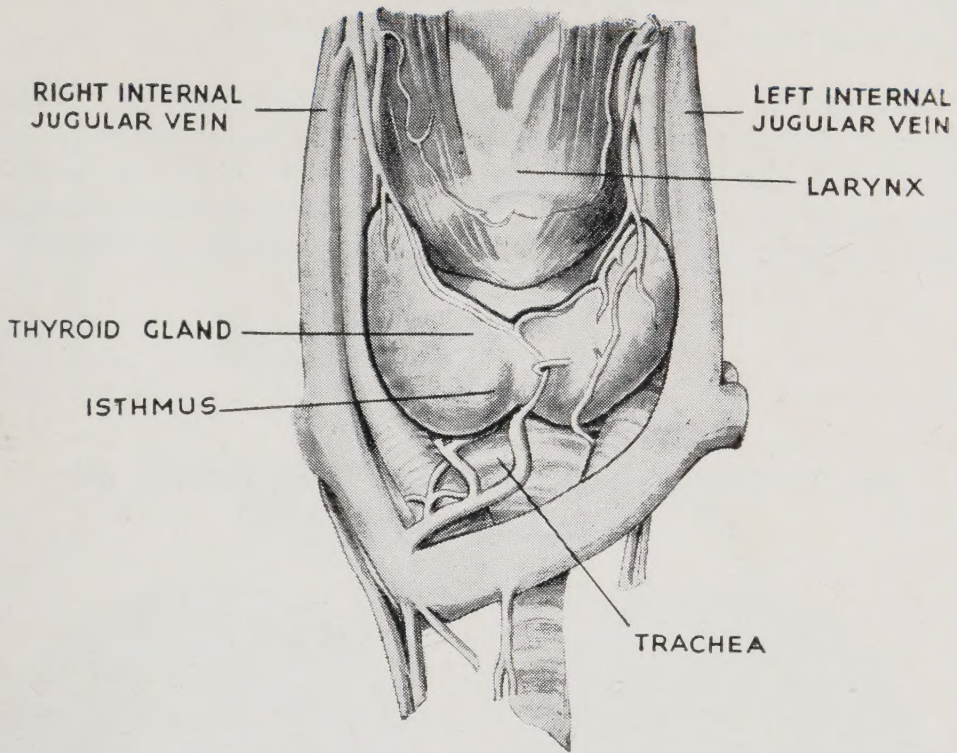
—causes MYXOEDEMA



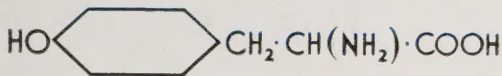
EXOPHTHALMIC GOITRE



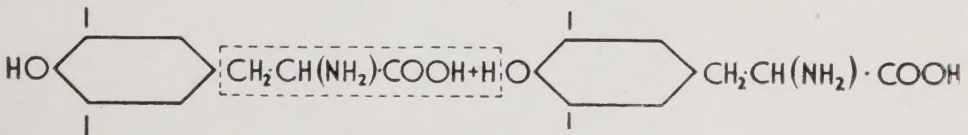
POSITION OF THYROID GLAND



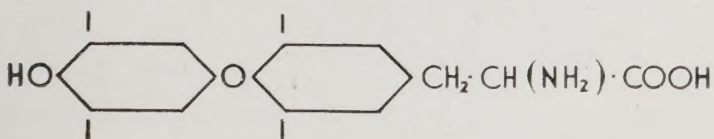
BIOLOGICAL SYNTHESIS OF THYROXINE



TYROSINE + IODINE



DIIODOTYROSINE

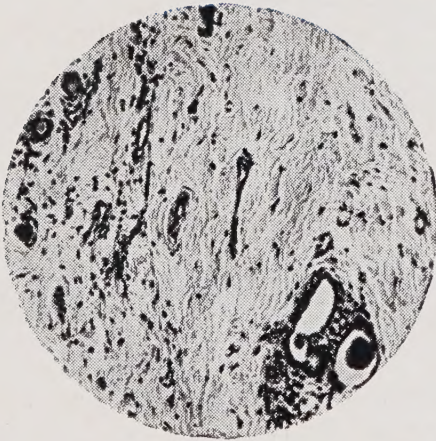


THYROXINE

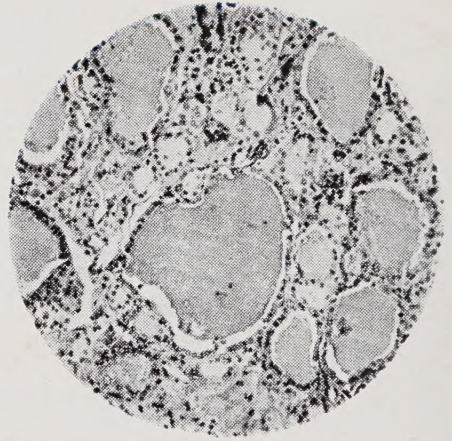
Iodinated proteins are not likely to be used in medicine, but they have a possible use in veterinary practice. Cows fed with iodinated proteins give an increased yield of milk.

It is easy to observe the action of the thyroid gland by adding a small quantity of thyroid extract or thyroxine to the water in which tadpoles are kept. The thyroid speeds up the metabolic process of the tadpoles, and they develop much more quickly than controls kept in water without the addition of thyroid.

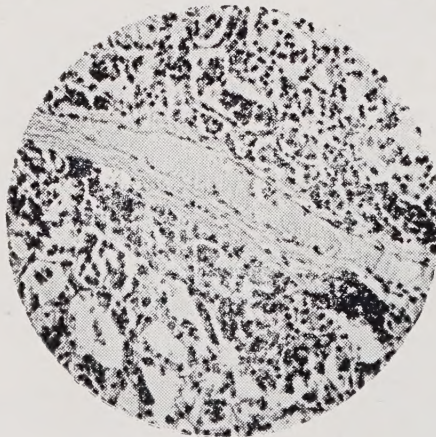
PHOTOMICROGRAPHS OF SECTIONS OF THYROID GLAND



UNDERACTIVE
THYROID

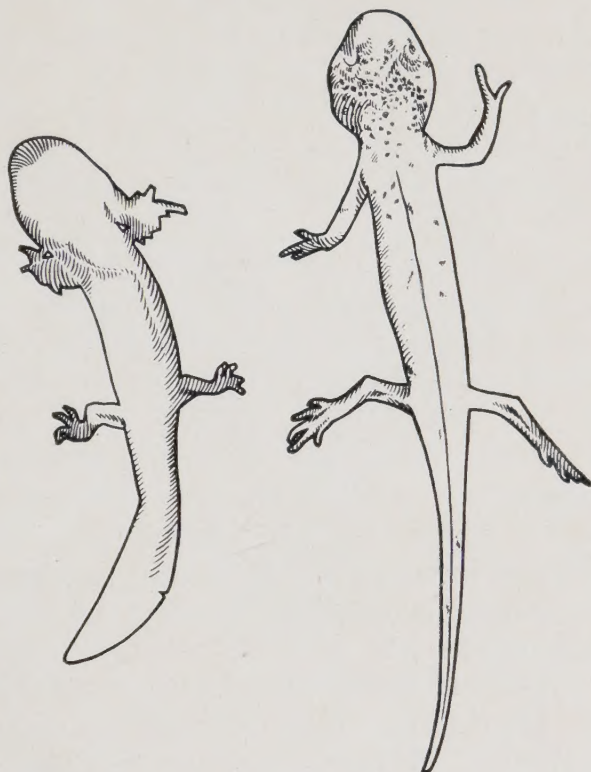


NORMAL
THYROID



OVERACTIVE THYROID

THE AXOLOTL



The Axolotl which never grows into the land form in nature, if fed on thyroid gland develops air breathing organs and becomes a land animal.

Another example of the action of the thyroid hormone is seen when the Mexican salamander, *Axolotl*, is fed on thyroid. In nature, the *Axolotl* never grows up into a land form, but the addition of thyroid or thyroxine produces a land animal. The addition of iodine to the diet is ineffective, as the salamander has not the power to utilise iodine owing to an inefficient thyroid. On the other hand, there are some tadpoles in mountain lakes which fail to develop because of lack of iodine, but do so when iodine is added to their water. These biological experiments are interesting, as they indicate that our personality depends, in part at least, upon heredity and environment, and the important part played by minute amounts of highly potent substances. In effect, it is possible even with a limited knowledge, to see the effects of an under- or over-

production of hormones. The thyroid regulates the production of energy and controls physical and mental development. An over-active thyroid produces well-known and typical symptoms. There is a bulging of the eyeballs (exophthalmos), loss of weight, and an increase in the heart rate, together with a general attitude of anxiety and restlessness. A slightly over-active thyroid produces a vivacious and dynamic personality, which tends to be rather unstable, whilst the accompanying slight exophthalmos can sometimes add to the attractiveness of the features.

An under-active thyroid produces a condition known as cretinism in children, and myxoedema in adults. In children there is a retarded state of development which is obvious, and a general attitude of apathy. In adults, the symptoms are the opposite of an over-active thyroid. All the metabolic processes are slowed down, and there is a lethargic condition.

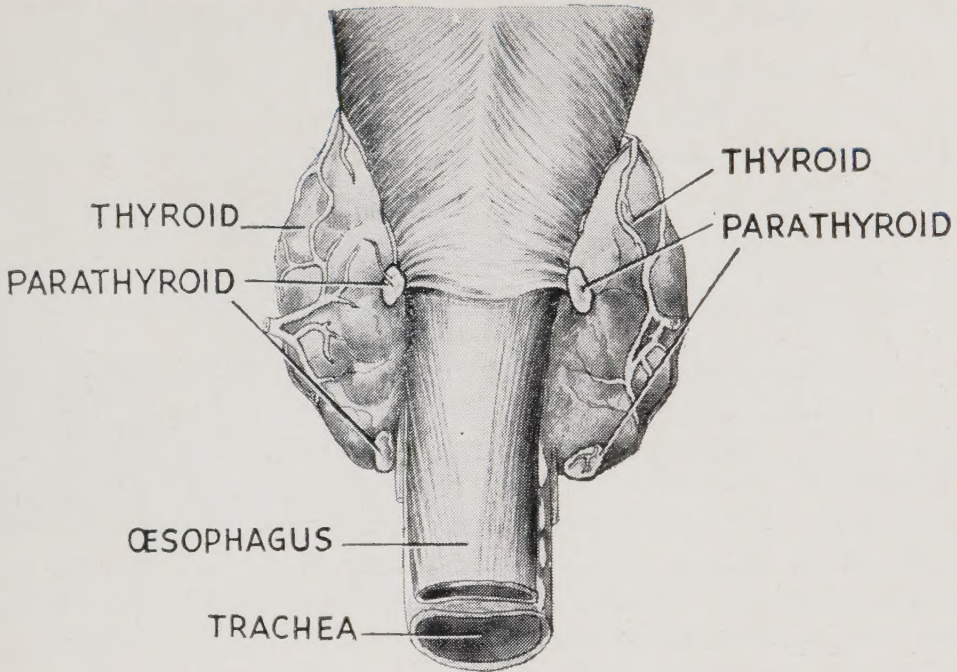
Until comparatively recently the only satisfactory treatment for an over-active thyroid was the surgical removal of a portion of the gland, but following the observation that some vegetables, particularly cabbage, produced large thyroids in rabbits, and that sulphaguanidine was also able to give rise to hyperthyroidism. Astwood found that thiourea and thiouracil were effective in controlling hyperthyroidism. Many clinical reports have recently been published on thiourea and thiouracil, and also methyl thiouracil and propyl thiouracil; these latter two being considered less toxic. These reports are all unanimous concerning the value of these preparations in the treatment of hyperthyroidism. The treatment must be carefully controlled, as these compounds are likely to give rise to toxic effects, and over-dosage can produce a condition of myxoedema. They are considered to act by preventing iodine from combining with tyrosine.

The treatment of myxoedema is most effective and dramatic, and consists in the administration of thyroid tablets. Thyroxine, the hormone of the thyroid gland, which does not have quite the same action as a whole gland, is usually reserved for cases which cannot take thyroid by the mouth, as it can be given in the form of its sodium salt by intravenous injection.

The Parathyroid Glands

The parathyroid glands are brownish-red bodies about 3 to 15 mm. long, and 2 to 3 mm. wide, situated on the under surface of the thyroid. Usually four glands are found in man.

POSITION OF PARATHYROID GLANDS



Early experimental work at the beginning of the present century showed that the removal of the glands always caused tetany in animals, death following in most cases after a few days. This is a condition of neuro-muscular irritability resulting in muscular spasm, which should not be confused with tetanus or lockjaw—an infectious disease resulting from contamination of wounds or raw surfaces by spores of tetanus bacilli. It was then shown that tetany following extirpation of the parathyroids was associated with a fall in the blood calcium, and that the injection of calcium salts temporarily improved the condition. The parathyroid glands were producing an internal secretion or hormone which was essential for the maintenance of the correct level of the calcium in the blood. Attempts were made to obtain active extracts from the gland, and Collip, in 1925, conclusively proved the existence of a parathyroid hormone, known as 'parathormone'. The most highly purified preparations of parathormone indicate that it consists essentially of a protein, which is destroyed by boiling with acid or alkali; to be effective it must be given by injection.

Extracts of parathyroid glands are available, but there is at present no international standard, and the unit of activity is usually found by observing the rise in blood calcium produced in dogs whose parathyroid glands have been removed.

The parathyroid hormone has not been used very extensively, as it acts by drawing the calcium from the bones into the blood-stream ; very careful control is necessary, and it is usual to decrease the phosphorus of the diet and to administer calcium salts in addition by injection. The injection of parathormone seems to be ineffective after two or three weeks, owing to the development of anti-hormone substances.

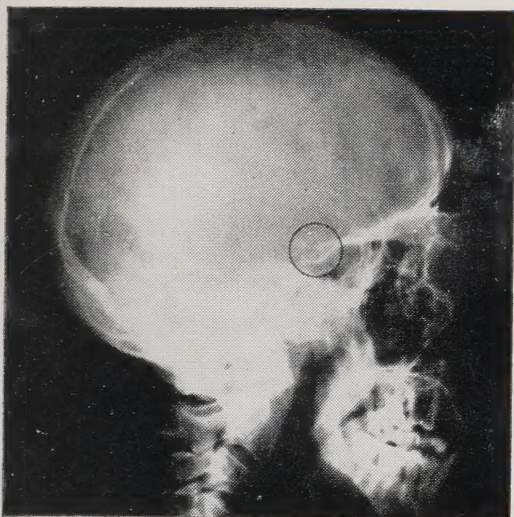
Recently, a compound known as 'Dihydrotachysterol' or A.T.10 (anti-tetany No. 10), which is one of the products of ultra-violet irradiation of ergosterol in the preparation of Vitamin D, has been favourably reported upon in the treatment of tetany. It is given orally, but the material is expensive and difficult to obtain, and careful control is needed during its administration. Synthetic Vitamin D has not these drawbacks, and has recently been used with success over long periods.

The Pituitary Gland

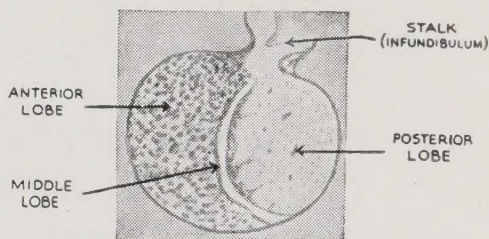
The pituitary gland is a small but most important gland which is situated at the base of the brain, and it would seem that Nature has chosen this safe position on account of its importance.

The gland consists essentially of two lobes and a small section dividing the lobes called the 'pars intermedia'. Although experimental work has shown that many different hormones are secreted by the gland, and highly active preparations of many of these substances have been made, the different hormones have not been completely separated, and work on them has been difficult on account of the small amounts present in the gland.

PITUITARY GLAND



The pituitary lies at the base of the brain well protected by layers of bone.

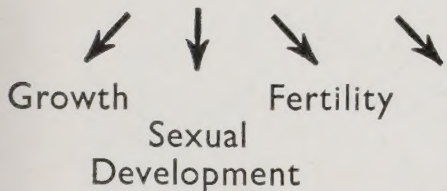


SECTION OF THE PITUITARY GLAND

THE MASTER GLAND

ANTERIOR LOBE

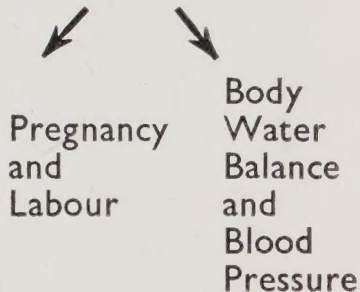
controls



Other Key Glands :—
Sex Glands
Thyroid
Adrenals
Pancreas
Breasts

POSTERIOR LOBE

controls



PITUITARY OVERACTIVITY

Children Giants
Premature Sexual Maturity

Adults - Acromegaly
Enlargement of hands and feet
Sex Abnormalities

PITUITARY UNDERACTIVITY

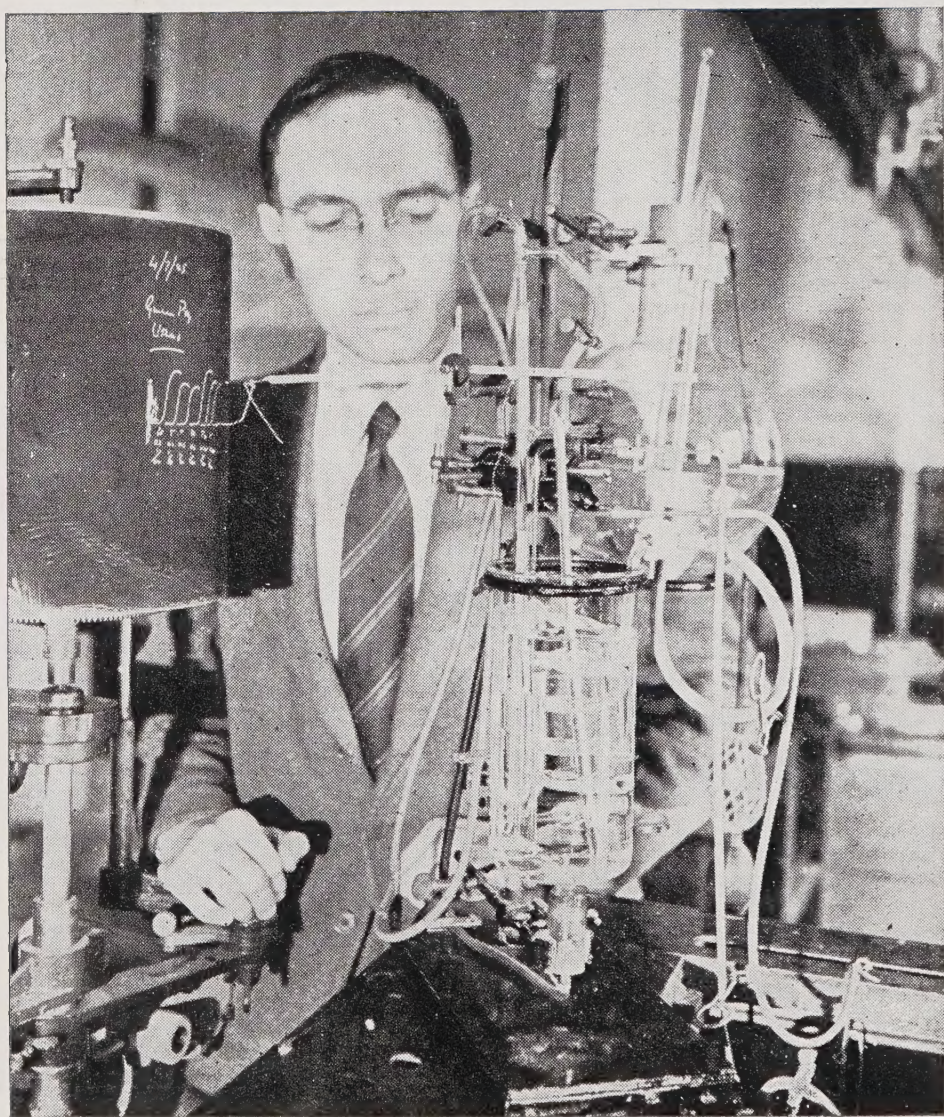
Children Arrested Growth (Dwarf)
Failure of Sex Development

Adults - Excessive Fatness
High Blood Pressure
Thirst

Posterior Lobe

Extracts from the posterior lobe (*e.g.*, Liquid Extract of Pituitary—B.P.) can be separated into two fractions—one containing an oxytocic principle which causes a contraction of the uterus (the word ‘oxytocic’ is derived from Greek words meaning ‘quick labour’), and one consisting mainly of a substance which causes a rise in blood-pressure under certain conditions, and which has also an important anti-diuretic effect ; in other words, it reduces the amount of urine excreted.

ASSAY OF PITUITARY POSTERIOR LOBE EXTRACT



Posterior pituitary extracts are assayed for their oxytocic action by observing their effect on the isolated uterus of a virgin guinea-pig and comparing them with a standard extract of known strength.

Posterior pituitary extracts are used for the induction of labour and to control post-partum haemorrhage ; in the treatment of diabetes insipidus, a condition in which excessively large amounts of urine are excreted ; and to raise the blood-pressure after shock. The rise in blood-pressure is, however, not observed in normal animals, and they are not used very extensively for this purpose. They act directly on the muscle wall of the capillaries, and by restricting the flow of blood in them, thus raise the blood-pressure. Pituitary extracts act differently from adrenaline and their action is more prolonged.

Pars Intermedia

The 'pars intermedia'—the small portion of gland dividing the two lobes—contains an active principle which turns frogs black by expanding special cells in their skin known as 'melanophores'. The frog finds this very useful when he wishes to hide, but in humans its function is unknown, since human skin does not contain any melanophores.

Posterior pituitary extracts are usually given by injection. They are practically inactive by mouth, but they have recently been administered with success in the form of a snuff for the treatment of diabetes insipidus.

Anterior Lobe

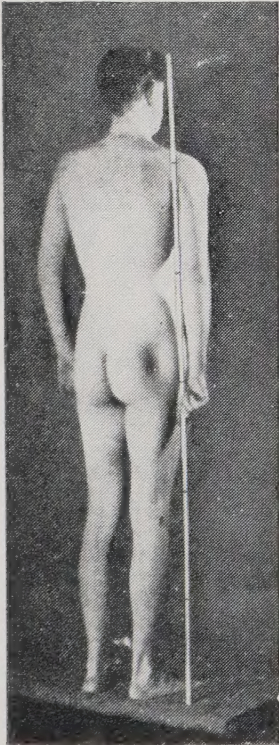
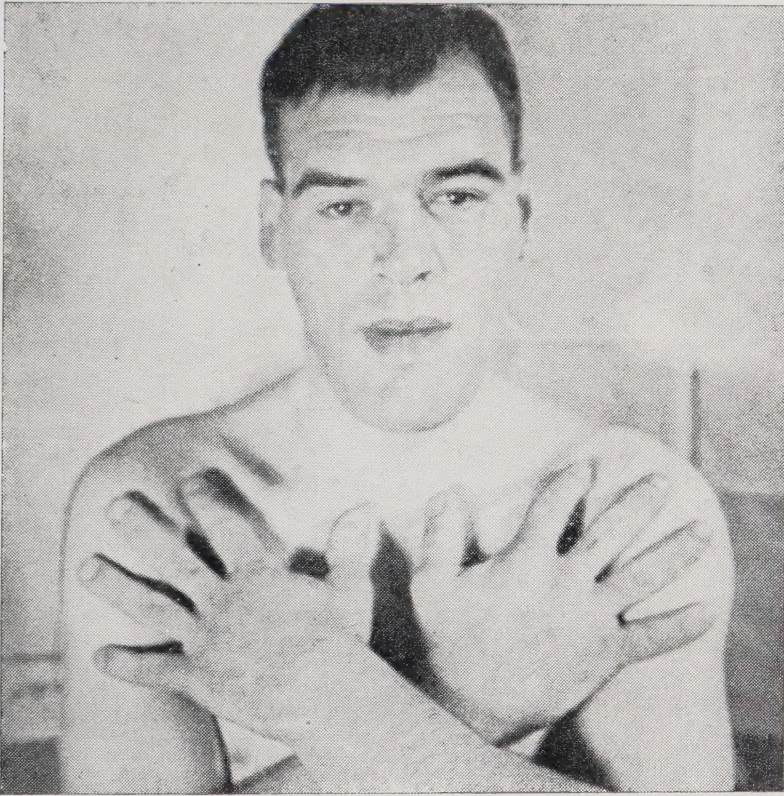
The anterior lobe of the pituitary gland secretes at least nine different substances. None of them has been obtained in a state of chemical purity, but they have most important effects on the whole body, as they control the secretion of hormones in other endocrine glands. On account of this, the anterior lobe of the pituitary gland has been called the 'master gland', and by one eminent authority, the 'leader of the endocrine orchestra'.

Hormones secreted by the Anterior Lobe of the Pituitary Gland

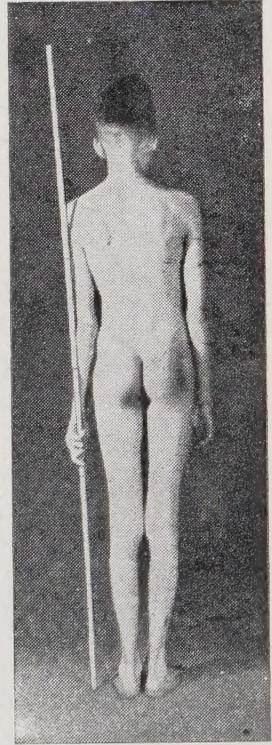
<i>Hormone</i>	<i>Function</i>	<i>First described</i>
Growth Hormone ..	Necessary for correct skeletal development	Evans and Long, 1921
Gonadotrophic Hormones :		
(a) Follicle-stimulating factor ..	Controls development of Graafian follicles	Fevold and Hisaw, 1933
(b) Luteinising factor ..	Essential for production of corpora lutea ..	Fevold and Hisaw, 1933 Wallan-Lawrence, 1934
Lactogenic Hormone (Prolactin) ..	Stimulates milk secretion	Riddle, Bates, and Dykshorn, 1932
Diabetogenic Hormone	Raises the blood sugar	Houssay, 1931-1933
Ketogenic Hormone ..	Essential for Ketogenic metabolism.. ..	Burn and Ling, 1929-1930
Pancreatrophic Hormone	Stimulates insulin production by the pancreas	Anselmino and Hoffman, 1933
Thyrotrophic Hormone	Essential for correct functioning of the thyroid gland ..	Loeb, 1929 Aron, 1929
Parathyrotrophic Hormone	Controls development and function of the parathyroids ..	Hertz and Kranes, 1934
Adrenocorticotrophic Hormone	Essential for the correct functioning of the adrenal cortex ..	Smith, 1930

The growth hormone is essential for correct skeletal development, and an animal deprived of its pituitary when young does not grow up. Some dwarfs are known to have an under-active anterior pituitary gland ; they differ from the stunted growth of cretins due to a deficient thyroid, as they may be normal in other respects. Over-activity of the anterior pituitary produces individuals of larger stature than the average. Giants have an over-active anterior pituitary due to an excessive secretion of the hormone before the bones are fully set. After the bones are fully set, a condition known as 'acromegaly' results. The features are coarse and the bones of the hands and feet are very large in proportion to the rest of the body.

A CASE OF ACROMEGALY DUE TO AN OVER-ACTIVE ANTERIOR PITUITARY GLAND



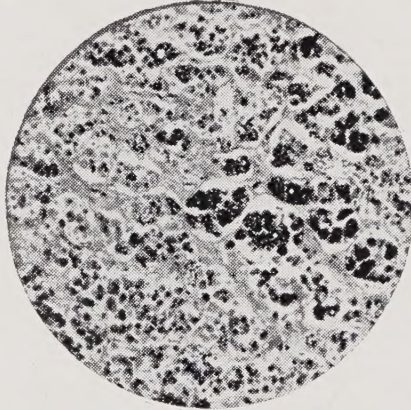
The boy (left) is aged sixteen and has an over-active Anterior Pituitary gland



The boy (right) is aged nineteen and has an under-active gland

The following photomicrograph is a section of the anterior pituitary gland which has been stained with eosin and pyrrol-blue. Three types of cells are present in the gland in varying proportions—chromophobe cells, which are only faintly stained with aniline dyes ; and chromophyl cells, which are divided into acidophiles and basophiles, according to their staining properties. Acidophiles are stained by acid dyes such as eosin, and basophiles with basic dyes such as pyrrol-blue. The chromophobe cells appear to be the 'mother' cells from which both basophile and acidophile cells are derived.

Photomicrograph of a section of the anterior pituitary gland showing three kinds of cells



An examination of sections of the pituitary in pathological conditions may show an excessive growth of one type of cell ; for example, in acromegaly, there is a diffuse growth of the cells which are stained with eosin, and this condition is sometimes known as eosinophile adenoma of the pituitary.

A disease known as 'Cushing's syndrome' results from a tumour of the basophile cells : in other words, there is an excessive growth of the cells which are stained with basic dyes.

There are two hormones secreted by the anterior pituitary gland which are probably the same in both sexes, stimulating the ovaries in the female and the testes in the male to secrete their natural hormones. They are of particular importance in sex hormone therapy, as a very close interrelationship exists between these gonad-stimulating or gonadotrophic hormones and the hormones secreted by the ovaries and testes. In some cases the thyroid gland also plays a part in the correct functioning of these different glands. The balance must be correct ; an over- or under-production of hormones by any one gland directly influences other glands, thus making accurate diagnosis and treatment difficult.

ANTERIOR LOBE OF THE PITUITARY

Inhibitory substance
Interstitial-cell stimulation
fraction, etc.

Gonadotrophins
(Gonadotrophic substances)

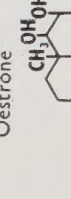
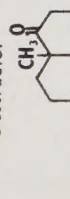
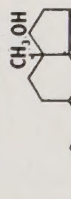
Prolactin
(Lactogenic substance)

Mare serum gonadotrophin
Follicle stimulating fraction
(Prepared from pregnant mares' serum)

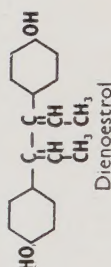
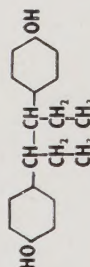
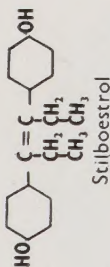
Chorionic gonadotrophin
Luteinizing fraction
(Prepared from pregnancy urine)

OVARY

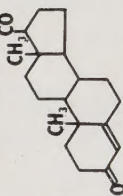
Natural
Ovarian
Hormones



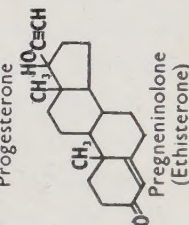
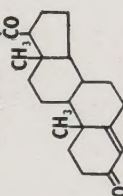
Synthetic
Substances



Natural
Corpus Luteum
Hormone

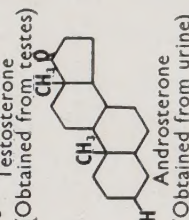
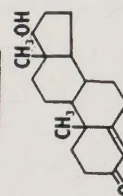


Synthetic
Substances

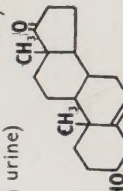
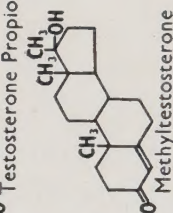
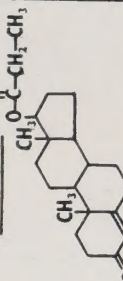


TESTIS

Natural
Testicular
Hormone



Synthetic
Substances



Intermediate for synthetic Testosterone, etc.,
Excreted in large amounts in cases of adrenal cortical tumour;

The Gonadotrophins

Two kinds of gonadotrophic or anterior pituitary-like (A.P.L.) substances are available in addition to glandular extracts, and they have a similar action to the hormones produced by the gland.

It was discovered by Cole and Hart, in 1930, that the blood serum of pregnant mares contained large amounts of a hormonal substance which stimulated the follicles in the ovaries of females and the development of the testes in males.

Extracts have also been prepared from pregnancy urine which contain a fraction which stimulates the formation of corpora lutea in the ovary. Many different names have been given to these extracts in addition to trade names, and in the past there was some confusion on their unit of activity, as different manufacturers adopted different units. There is now an International Unit for gonadotrophins—the name given to substances having an anterior pituitary-like action—one International Unit of mares' serum gonadotrophin is defined as the specific gonadotrophic activity of 0.25 mg. of a standard preparation, and one International Unit of 'chorionic' gonadotrophin—the name given to anterior pituitary-like hormones of pregnancy urine—is the activity of 0.1 mg. of the standard preparation.

THE PHYSIOLOGICAL ACTION OF MARES' SERUM GONADOTROPHIN



Ovaries and uterus of an immature
rat before treatment

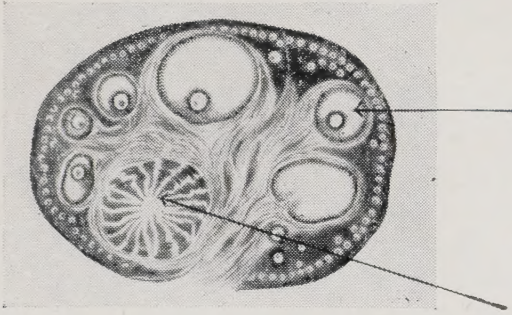


Ovaries and uterus of an immature
rat after treatment

The preparations are standardized biologically by observing their effects on rats or mice whose ovaries have been removed, and comparing them with the international standard.

SEX GLANDS

OVARIES



Section through the Ovary
(Diagrammatic)

This part produces
OESTRADIOL

This part produces
PROGESTERONE

OESTRADIOL

Responsible for normal sex development and function in the female.
Useful in treatment of sex disorders in women.



♂ = Male ♀ = Female

In Poultry, Oestradiol has the remarkable action of changing the colouring of the male plumage to that of the hen.

PROGESTERONE

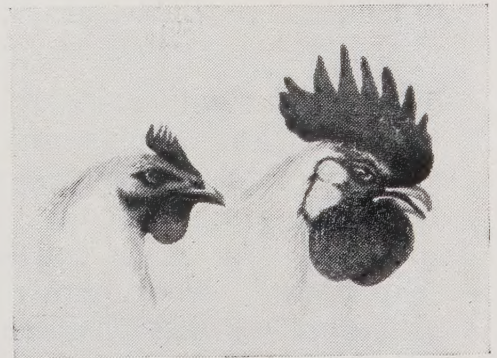
Used in the prevention of abortion

TESTES

In the male, the sex changes at puberty are brought about by a hormone in the testes.

TESTOSTERONE

Used to treat deficiency conditions in which sex characteristics are abnormal.



The photographs show the remarkable effect of testosterone in developing the comb of an immature cockerel.

The Gonads :

Natural Oestrogens

In 1923, Allen and Doisy first showed that an alcoholic extract of the ovary was capable of producing oestrus in rats and mice after their ovaries had been removed, and the active principle from these extracts was called 'oestrin', indicating that it was a substance capable of producing 'oestrus' or heat in animals. Owing to the great difficulty in obtaining sufficient material, it was not possible to determine their chemical nature or constitution. However, in 1927, Zondek and Aschheim found that similar substances could be extracted from pregnant mares' serum. Chemists succeeded in isolating several oestrogenic substances in a state of chemical purity, and it is now thought that the natural hormone of the ovary is oestradiol.

These oestrogenic substances all contain a phenanthrene ring structure and are closely related to the sterols—*e.g.*, calciferol and ergosterol. Natural oestrogenic hormones are still used, but greater interest has been taken in the synthetic oestrogens which are cheaper and possess the great advantage of being more highly active when given by mouth.

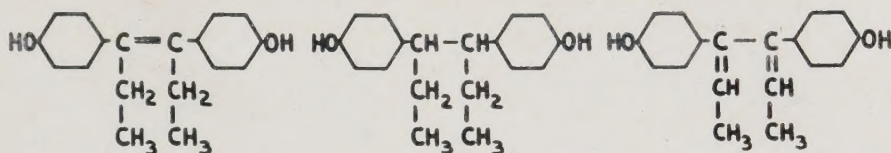
Synthetic Oestrogens

At first, attempts were made to find a synthetic substance with a similar constitution to the hormones obtained from the urine of pregnancy, and a very large amount of experimental work has been carried out since 1933 by Professor Dodds and others, during which time many hundreds of different preparations have been prepared and examined.

Substances with a similar structure to the natural oestrogens had very little, if any, oestrogenic activity. Attempts were then made to simplify the molecule, and a substance which bore little resemblance to the natural oestrogens was shown to have very high activity. This substance, known as 'stilboestrol', or, in America, 'diethylstilboestrol', is 4:4-dihydroxy- α - β -diethylstilbene, and was introduced in 1939.

Several other synthetic substances have been investigated: hexoestrol was introduced in 1940, and dienoestrol in 1944, but comparatively little has been published on their relative activity, and stilboestrol is the most widely used synthetic oestrogen.

SYNTHETIC OESTROGENS

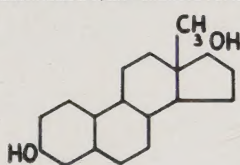


Stilboestrol

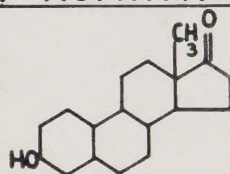
Hexoestrol

Dienoestrol

Natural Ovarian Hormones



Oestradiol



Oestrone

Comparative activity of natural and synthetic oestrogens

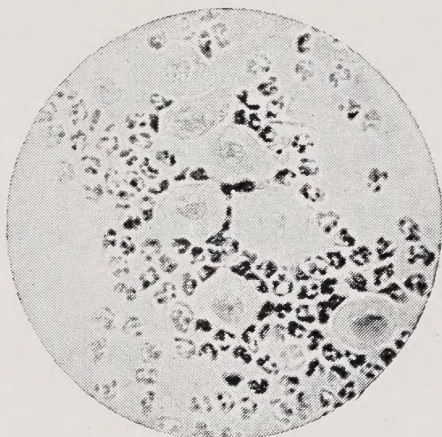
It is possible to compare the activity of natural and synthetic oestrogens in the laboratory by a microscopic examination of a smear preparation from the vaginal fluid. The cells lining the vaginal walls differ in appearance during the oestrous cycle in mice and rats, and the potency of different extracts can be easily obtained by this method.

International standard preparations are available for oestrone and oestradiol benzoate, 1 mg. of oestrone being equivalent to 10,000 International Units, and 1 mg. oestradiol benzoate the equivalent of 10,000 International Benzoate Units.

As the synthetic oestrogens are pure synthetic substances, they are usually referred to by weight only.

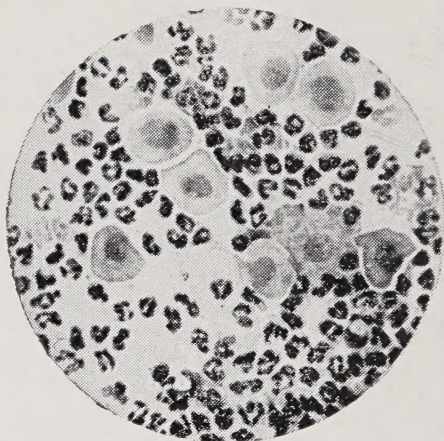
COMPARATIVE ACTIVITY OF NATURAL AND SYNTHETIC OESTROGENS

Effect of 0.00025 mg. Stilboestrol
(synthetic) on vaginal epithelium
of ovariectomised rat



Before administration
(Dioestrus stage)

Effect of 0.0005 mg. Oestrone
(natural) on vaginal epithelium
of ovariectomised rat



Before administration
(Dioestrus stage)



After administration
(Oestrus stage)



After administration
(Pro-oestrus stage)

Uses of Oestrogens

The natural and synthetic oestrogens are now widely recommended for a number of different conditions. They are all highly potent substances which should not be used except under medical direction.

PREPARING VAGINAL SMEARS



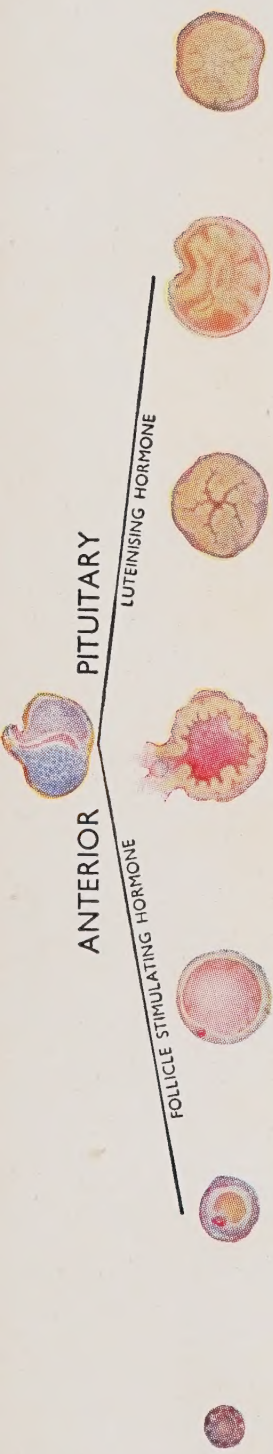
The Uses of Oestrogens

The symptoms at the menopause can be controlled most effectively with small doses of stilboestrol, hexoestrol, or dienoestrol, by the mouth ; injections are only rarely necessary. When a very prolonged action is required, small tablets can be implanted under the skin, and ointments and creams are also available.

An important use of synthetic oestrogens in the male is in the treatment of cancer of the prostate gland, the gland which is situated at the neck of the bladder. It is believed that they act by neutralising in some way the effects of the male hormone which activates the prostatic tissues. Stilboestrol has only proved to be of value in this one type of cancer, and is of no value in simple enlargement of the prostate. It has also been tried for carcinoma of the breast in the female, but the results are very uncertain.

**MATURATION
OF GRAAFIAN
FOLLICLE IN
OVARY**

(End organ of
Anterior Pituitary)

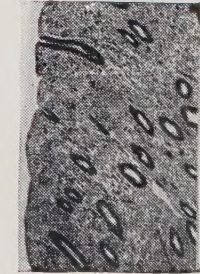
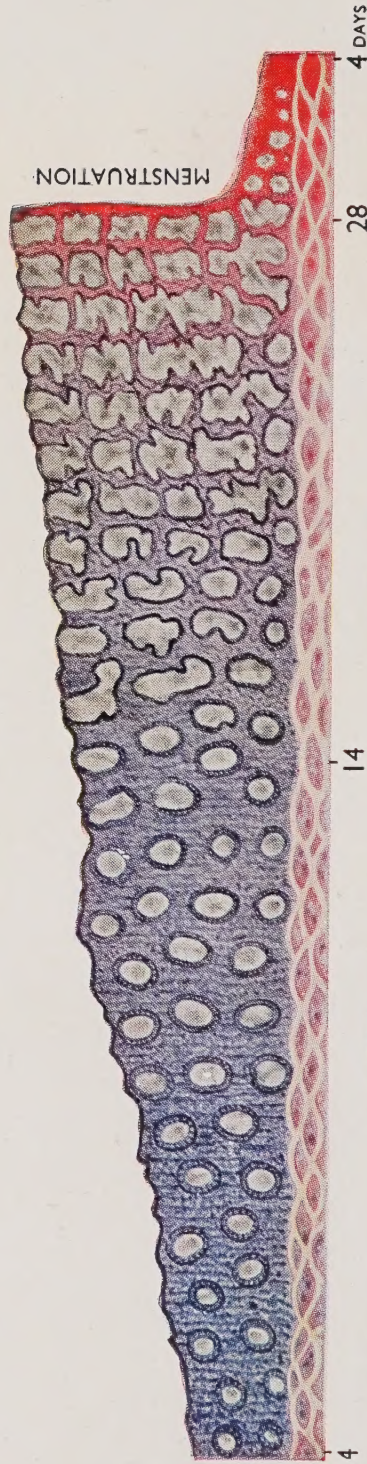


**LEVELS OF
HORMONES OF OVARY
{ OESTRADIOL**

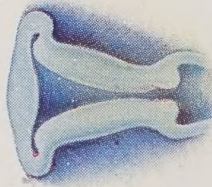
PROGESTERONE



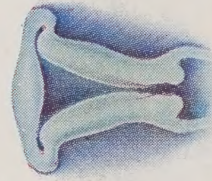
**CHANGES IN
ENDOMETRIUM
OF
UTERUS**
(End organ of
Ovarian
Hormones)



Photomicrograph of Endometrium
in preovulatory phase (X 100)



UTERUS ACTIVE



UTERUS PASSIVE



Photomicrograph of Endometrium
in postovulatory phase (X 100)

Hormones and the Female Sex Cycle

The human female reproductive or menstrual cycle is dependant upon the production of the correct amounts of hormones by the ovaries and anterior pituitary gland.

A follicle-stimulating hormone (Antostab) stimulates the ovary to secrete 'oestradiol' during the cycle, and a luteinising hormone (Physostab) stimulates the production of 'progesterone' during the second half of the cycle.

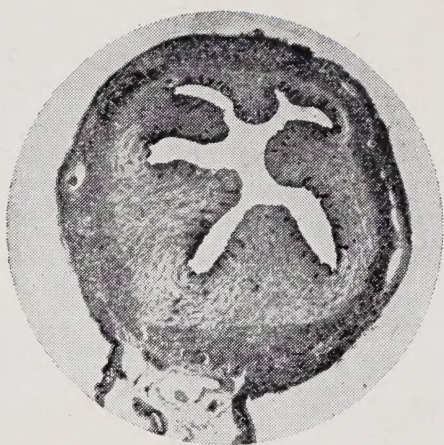
At about the fourteenth day in each cycle, an ovum is expelled from the ovary, and progesterone is secreted in the ruptured follicle left in the ovary. The output of oestradiol and progesterone falls rapidly after about twenty-eight days, when menstruation occurs. Under the influence of two different hormones from the anterior pituitary gland and two from the ovaries, there is a continuous building-up and shedding of the endometrium (or lining membrane) of the uterus, and when these glands do not function normally, various irregularities occur which can sometimes be corrected by hormone therapy.

A self-explanatory representation of the normal menstrual cycle will be found on the inset facing.

Corpus Luteum Hormone

After ovulation and also during pregnancy, a substance is formed in the ovary from a gland called the 'corpus luteum', which develops in the ruptured follicle. Korner and Allen, in 1929, made extracts of corpora lutea, and with great difficulty isolated from 50,000 sows' ovaries about 1 G. of progesterone. In 1935, Butenandt succeeded in preparing progesterone synthetically from stigmasterol—a sterol from soya bean oil. The synthetic hormone has exactly the same action as the natural hormone, and most proprietary preparations are made from it. Progesterone has been called the 'hormone of pregnancy', as it is essential in the continuance of intra-uterine life. The main use of progesterone is in the prevention of abortion, and it is the only hormone which is essentially female and is not excreted by the male. Progesterone must be given by injection, but an orally active analogue called ethisterone or anhydroxyprogesterone is now available. The oral dose is approximately six times the dose of progesterone by injection.

BIOLOGICAL ASSAY OF THE CORPUS LUTEUM HORMONE



Section of uterus of immature rabbit after preliminary sensitization with oestradiol benzoate showing no endometrial proliferation



Section of uterus of immature rabbit sensitized with oestradiol benzoate and treated with corpus luteum hormone showing very marked endometrial proliferation

Assay of Progesterone

Corpus luteum extracts and progesterone are assayed in the laboratory by observing their effects on the rabbit's uterine endometrium. The above photomicrographs are sections of the uterus of an immature rabbit before and after treatment with progesterone. The effect of progesterone is to increase the complexity of the endometrium and prepare it for implantation of the ovum.

Androgens

As with the female, several hormones are secreted by the male.

The natural hormone of the testis was first thought to be androsterone, but it is now known to be testosterone. Testosterone has been prepared synthetically from cholesterol; it has a similar constitution and action to the natural hormone, and is available as a solution of testosterone propionate in oil for injection. Testosterone is not active orally, but an orally active form called 'methyl testosterone' is available in tablets for oral administration. Approximately six times as much methyl testosterone by weight must be given to have a similar effect to testosterone propionate by injection.

Although the principal use of the male sex hormones is in the treatment of conditions in the male, they are also used in gynaecology when it is desired to antagonise the effects of over-production of the female hormone. It is, perhaps, not quite accurate to speak of male and female hormones, as with the exception of progesterone, both male and female secrete both types of compounds, and the relative amount of male and female hormone produced plays a part in the determination of the characteristics of the individual.

PREPARING SECTIONS FOR MICROSCOPICAL EXAMINATION



The effect of injecting different hormones into capons or castrated cocks illustrates the profound influence they have on the nature of the bird. Oestrone or stilboestrol causes the feathers to change colour from a dark blue or black to brown—the colour of the normal female. The injection of the male hormone into a capon produces a greatly increased growth in the comb, and the injection of an oestrogen into a cock causes the comb to shrink. In other words, the whole character of the bird can be altered by small amounts of these highly potent natural or synthetic hormones.

Hormones play an important part in the moulding of our personality and, indeed, it can be said that many people are what they are because of over- or under-activity of one or more of their endocrine glands. This fact should occasionally be considered when we judge others. It may be that their hasty temper is not their fault, but is due to an over-active adrenal gland, and a rather stupid individual may only need some thyroid to stimulate a greater interest in his surroundings.

The chemist has succeeded in producing in the laboratory many hormones which can only be extracted from the glands with great difficulty, and also synthesized substances which have a similar action but which are chemically different from the natural hormones.



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H O R M O N E S

STANDARDIZED COMMERCIAL PREPARATIONS

I.U. = International Unit. I.B.U. = International Benzoate Unit.

1 mg. oestrone is equivalent to 10,000 I.U.

1 mg. oestradiol benzoate is equivalent to 10,000 I.B.U.

1 mg. progesterone is equivalent to 1 I.U.

1 mg. stilboestrol (orally or by injection) is approximately equivalent to

5,000 I.U. or I.B.U. natural oestrogen by injection, or 20,000 I.B.U. by mouth.

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
ADRENALINE		
Adrenaline	 $\frac{1}{2}$ ml. and 1 ml. ampoules; $\frac{1}{2}$ oz., 1 oz., and 2 oz. bottles (1 in 1,000 solution)	Evans
Adrenaline	 1 ml. ampoules (1 in 1,000 solution as salt of mucic acid)	Allen & Hanbury
Adrenaline	 1 ml. ampoules (1 in 1,000)	Burroughs Wellcome
Adrenaline in Oil	 1 ml. ampoules containing 2 mg.	Parke, Davis
Adrenaline Suspension with Ascorbic Acid..	 10 ml. vials containing 1 in 100 Adrenaline stabilised by addition of Ascorbic Acid.. ..	British Drug Houses
Adrenaline Inhalant	 5 ml. and 10 ml. bottles (1 in 100)	Burroughs Wellcome
Adrenaline Spray Solution	 1 in 1,000 in the form of tartrate; 10 ml. and 25 ml. vials..	Burroughs Wellcome
Adrenutol	 Solution A, 2 mg. per 1 ml. ampoule; Solution B, 1 mg. per 1 ml. ampoule	Evans
Renaglandin	 1 oz. bottles of 1 in 1,000 solution, Rectones (Suppositories), and Ointment	Oppenheimer
Suprarenalin	 1 ml. ampoules, 1 oz. and 1 litre bottles (1 in 1,000 solution); tablets, 1/1000 grain and 1/400 grain ..	Armour

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
Vasoconstrictine ..	1 ml. ampoules and 1 oz. bottles of 1 in 1,000 solution ; suppositories (10 min. of 1 in 1,000 solution) ; ointment, 1 in 1,000 ; tablets, 1/100 grain and 1/250 grain	Duncan, Flockhart

Also issued by various manufacturers as a 1 in 1,000 solution for injection, and as a 1 in 100 solution for oral inhalation.

CORPUS LUTEUM HORMONE AMPOULES (PROGESTERONE)

Gestone ..	1 ml. contains 1 mg., 2 mg., 5 mg., or 10 mg.	Paines & Byrne
Glanducorpin ..	1 I.U. in $\frac{1}{2}$ ml. ; 2 I.U. or 5 I.U. in 1 ml. . .	Richter
Lipo Lutin ..	1 ml. contains 2 mg. or 5 mg.	Parke, Davis
Luteomensin ..	1 ml. contains 0.5 mg.	Paines & Byrne
Luteostab ..	1 ml. contains 2 mg. or 5 mg.	Boots
Lutocyclin ..	1 ml. contains 2 mg., 5 mg., or 10 mg.	Ciba
Micryston ..	A microcrystalline suspension of progesterone in isotonic aqueous suspension, containing 2 mg. per ml. with 0.4% phenol ; vials of 8 ml.	Coates & Cooper
Progesterone ..	1 ml. contains 1 mg., 2 mg., or 5 mg.	Oxo
Progesterone ..	1 ml. contains 2 mg., 5 mg., or 10 mg.	Burroughs Wellcome
Progestin ..	1 ml. contains 1 mg., 2 mg., 5 mg., or 10 mg.	British Drug Houses
Progestin ..	1 ml. contains 1 mg. or 2 mg.	Lilly
Progestin ..	1 ml. contains 1 mg., 2 mg., 5 mg., or 10 mg.	Organon
Proluton ..	<i>Also in 5 ml. and 10 ml. vials containing 1 mg. per ml.</i> 1 ml. contains 2 mg., 5 mg., or 10 mg.	British Schering

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
CORPUS LUTEUM HORMONE TABLETS		
Corpus Luteum Granules ..	Each tablet contains 0.1296 G. desiccated corpus luteum ..	Armour
Corpus Luteum ..	Each tablet contains $\frac{1}{2}$ grain, 1 grain, 2 grains, or 5 grains extract of corpus luteum ..	Armour
Ethisterone ..	Each tablet contains 5 mg. or 10 mg. ethisterone..	British Drug Houses
Ethisterone ..	Each tablet contains 5 mg. ethisterone ..	Boots
Ethisterone ..	Each tablet contains 5 mg. ethisterone ..	Burroughs Wellcome
Gestone—Oral ..	Each tablet contains 5 mg. ethisterone ..	Paines & Byrne
Luteomensin ..	Each tablet contains $1\frac{1}{5}$ grain or $1\frac{1}{3}$ grain extract of corpus luteum ..	Paines & Byrne
Lutocyclin Linguets ..	Each tablet contains 5 mg. ethisterone ..	Ciba
Lutogyl Implants ..	Implantation tablets of 100 mg. ..	Roussel Labs.
Oraluton ..	Each tablet contains 5 mg. or 10 mg. ethisterone..	British Schering
Progesterone ..	Implantation pellets of 100 mg. ..	Organon
DEOXYCORTICOSTERONE ACETATE		
Cortiron ..	1 ml. ampoules containing 2 mg., 5 mg., or 10 mg. ..	British Schering
D.O.C.A. ..	1 ml. ampoules containing 2 mg., 5 mg., or 10 mg. per ml. Also 5 ml. vials, 5 mg. per ml., and implantation pellets of 100 mg. ..	Organon
Percorten..	1 ml. ampoules containing 5 mg. or 10 mg. ..	Ciba
Syncortyl ..	1 ml. ampoules containing 2 mg., 5 mg., or 10 mg., and implantation tablets of 100 mg. ..	Roussel Labs.

DIENOESTROL TABLETS

Dienoestrol	..	Each tablet contains 0.1 mg. or 0.3 mg.	..	..	Allen & Hanbury
Dienoestrol	..	Each tablet contains 0.1 mg., 0.3 mg., 1 mg., or 5 mg.	..	..	British Drug Houses
Dienoestrol	..	Each tablet contains 0.1 mg., 0.3 mg., 1 mg., or 5 mg.	..	..	Boots
Dienoestrol	..	Each tablet contains 0.1 mg., 0.3 mg., 1 mg., or 5 mg.	..	..	Glaxo
Dienoestrol	..	Each tablet contains 0.03 mg., 0.1 mg., 0.3 mg., 1 mg., or 5 mg.	..	..	Organon
Dienoestrol	..	Each tablet contains 0.1 mg., 0.3 mg., 1 mg., or 5 mg.	..	..	Paines & Byrne
Dienoestrol	..	Each tablet contains 0.3 mg., 1 mg., or 5 mg.	..	..	Richter
Dienoestrol	..	Each tablet contains 0.1 mg. or 0.3 mg.	..	..	Ward, Blenkinsop

ETHISTERONE(see *Corpus Luteum Hormone Tablets*, page 40)**GONADOTROPIC HORMONE FROM PREGNANT MARES' SERUM**

Antostab	..	Each ampoule contains 200 I.U. with solvent	..	..	Boots
Gestyl	..	Each ampoule contains 200 I.U., 400 I.U., 1,000 I.U., or 3,000 I.U.	..	..	Organon
Gonadotrophic Factor	..	5 ml. vials containing 300 Collip units per ml.	..	..	Armour
Gonadotrophon F.S.H.	..	Each ampoule contains 400 I.U., 1,000 I.U., 1,500 I.U., or 3,000 I.U. with solvent	..	..	Paines & Byrne
Gonadyl	..	Each ampoule contains 800 I.U. with solvent	..	..	Roussel Labs.
Luteoantin	..	Each ampoule contains 100 rat units or 400 rat units with solvent	..	..	Richter
Serogan	..	Each ampoule contains 200 I.U. or 1,000 I.U. with solvent	..	..	British Drug Houses

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
GONADOTROPIC HORMONE FROM PREGNANCY URINE		
Antuitrin 'S' (Antroidin)	.. 10 ml. vials, 100 I.U. per ml., and 5 ml. vials, 500 I.U. per ml.	Parke, Davis
Glanduantin	Each ampoule contains 100 rat units or 500 rat units with solvent (double ampoules)	Richter
Gonadotrophon L.H. ..	Each ampoule contains 100 I.U., 500 I.U., or 1,500 I.U. with solvent	Paines & Byrne
Gonan	Each ampoule contains 100 I.U. or 500 I.U. with solvent	British Drug Houses
Physostab	Each ampoule contains 100 I.U. or 500 I.U. with solvent	Boots
Pregnyl	Each ampoule contains 100 I.U., 500 I.U., or 1,500 I.U. with solvent	Organon
Prolan	Each ampoule contains 100 I.U. or 2,000 I.U. with solvent	Bayer
HEXOESTROL AMPOULES		
Hexoestrol	1 ml. contains 1 mg. or 5 mg.	British Drug Houses
Hexoestrol	1 ml. contains 1 mg. or 5 mg.	Paines & Byrne
Hexoestrol	1 ml. contains 1 mg. or 5 mg.	Evans
Hexoestrol Dipropionate Injection	1.5 ml. containing 15 mg.	Burroughs Wellcome
Synthovo	1 ml. contains 1 mg. or 5 mg.	Boots
HEXOESTROL TABLETS		
Hexoestrol	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	British Drug Houses
Hexoestrol	Each tablet contains 1 mg. or 5 mg.	Burroughs Wellcome
Hexoestrol	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	Evans

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
Hexoestrol	Each tablet contains 0.1 mg., 0.5 mg., 1 mg., or 5 mg.	Organon
Hexoestrol	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	Oxo
Hexoestrol	Each tablet contains 0.1 mg., 0.5 mg., 1 mg., or 5 mg.	Paines & Byrne
Hexoestrol	Each tablet contains 0.5 mg. or 1 mg.	Woolley
Synthovo	Each tablet contains 1 mg. or 5 mg.	Boots
Thelestrom	Each tablet contains Hexoestrol, 3 mg., Phenobarbitone, 20 mg.	G. W. Carrick
METHYL TESTOSTERONE TABLETS		
Erugon Pellets	Each pellet contains 5 mg. methyl testosterone	Bayer
Methyl Testosterone	Each tablet contains 5 mg.	Boots
Methyl Testosterone	Each tablet contains 5 mg.	British Drug Houses
Methyl Testosterone	Each tablet contains 5 mg.	Burroughs Wellcome
Micryston	Microcrystalline suspension of methyl testosterone in isotonic aqueous suspension, containing 2 mg. per ml. with 0.4% phenol; vials of 8 ml.	
Neo-Hombreol Mucosets	Each tablet contains 5 mg.	Coates & Cooper
Oraviron	Each tablet contains 5 mg. or 10 mg.	Organon
Perandren Linguets	Each tablet contains 5 mg.	British Schering
Virorone—Sub	Each tablet contains 5 mg.	Giba
Virorone—Oral	Each tablet contains 5 mg.	Paines & Byrne
	Each tablet contains 5 mg.	Paines & Byrne
OESTRADIOL AMPOULES		
	(usually Benzoate)	
Benzo-Gynoestryl	1 ml. contains 1,000 I.B.U., 10,000 I.B.U., or 50,000 I.B.U.	Roussel Labs.
Benztrone	1 ml. contains 10,000 I.B.U., 20,000 I.B.U., or 50,000 I.B.U.	Paines & Byrne

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
Di-Menformon	1 ml. contains 10,000 I.B.U. or 50,000 I.B.U.; also 5 ml. and 10 ml. vials	Organon
Di-Menformon, D.P. ..	5 ml. vials containing 5 mg. oestradiol dipropionate per ml. ..	Organon
Oestrin	1 ml. contains 1,000 I.B.U., 10,000 I.B.U., 20,000 I.B.U., or 50,000 I.B.U.	Oxo
Oestroform	1 ml. contains 1,000 I.B.U., 10,000 I.B.U., 20,000 I.B.U., or 50,000 I.B.U.	British Drug Houses
Oestrone	1 ml. contains 1,000 I.B.U. or 10,000 I.B.U.	Hewlett
Ovocyclin, B.	1 ml. contains 1 mg. or 5 mg. oestradiol benzoate	Ciba
Ovocyclin, P.	1 ml. contains 1 mg. or 5 mg. oestradiol dipropionate	Ciba
Ovostab	1 ml. contains 2,000 I.B.U., 10,000 I.B.U., or 50,000 I.B.U.	Boots
Progynon, D.P.	1 ml. contains 20,000 I.B.U. oestradiol dipropionate	British Schering
Progynon B. Oleosum ..	1 ml. contains 10,000 I.B.U. or 50,000 I.B.U.	British Schering
Unden	1 ml. ampoule contains 1,000 I.U. (aqueous) or 10,000 I.B.U. (oily); 2 ml. ampoule contains 50,000 I.B.U. (oily); 10 ml. vial contains 10,000 I.B.U. per ml. ..	Bayer
OESTRADIOL TABLETS		
Gynoestryl	Each tablet contains 0.025 mg.; implantation tablets of 20 mg.	Roussel Labs.
Gynoestryl 'S'	Each tablet contains 0.2 mg.	Roussel Labs.
Oestroform	Mixed ovarian hormones. Each tablet contains 1,000 I.U., 5,000 I.U., or 10,000 I.U.	British Drug Houses
Oestradiol	Implantation pellets of 20 mg.	Organon
Ovocyclin	Each tablet contains 0.04 mg., 0.1 mg., or 1 mg.	Ciba

OESTRADIOL AND BENZOATE PREPARATIONS

Di-Menformon Ointment	..	1 G. contains 20,000 I.B.U. oestradiol benzoate	..	<i>Organon</i>
Ecto-Gynoestryl Ointment	..	25 G. contains 2·5 mg. oestradiol	..	<i>Roussel Labs.</i>
Ecto-Gynoestryl Solution	..	10 ml. contains 5 mg. oestradiol	..	<i>Roussel Labs.</i>
Gynoestryl Solution for Oral use	..	10 ml. contains 1 mg. oestradiol	..	<i>Roussel Labs.</i>
Oestroform Ointment	..	1 G. contains 1,000 I.U.	..	<i>British Drug Houses</i>
Oestroform Pessaries	..	Each pessary contains 1,000 I.U. Adults' or children's sizes (same strength)	..	<i>British Drug Houses</i>
Ovocyclin Ointment	..	1 G. contains 0·1 mg. oestradiol	..	<i>Ciba</i>
Progynon Ointment	..	25 G. contains 2·5 mg. oestradiol in neutral base	..	<i>British Schering</i>
Progynon Vaginal Capsules	..	Each capsule contains 0·25 mg. oestradiol	..	<i>British Schering</i>
Progynon Vaginal Suppositories	..	Each suppository contains 0·36 mg. oestradiol	..	<i>British Schering</i>
Sedo-Gynoestryl	..	1 ml. contains 1,000 I.U. oestradiol with 0·5 G. NaBr and 0·02 G. Ext. Hyoscyami.	..	<i>Roussel Labs.</i>

OESTRIOL

Theelol Capsules	..	Each capsule contains 0·12 mg. of trihydroxyoestratriene	..	<i>Parke, Davis</i>
Tridestrin	..	Each tablet contains 500 mouse units, 1,000 mouse units, 5,000 mouse units, or 10,000 mouse units	..	<i>Paines & Byrne</i>

OESTRONE AMPOULES

Glandubolin	..	1 ml. contains 1,000 I.U., 10,000 I.U., or 50,000 I.U.	..	<i>Richter</i>
Ketodestrin	..	1 ml. contains 500 I.U., 1,000 I.U., 5,000 I.U., or 10,000 I.U...	..	<i>Paines & Byrne</i>

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
Menformon	1 ml. contains 100 I.U., 1,000 I.U. (aqueous), or 10,000 I.U. (in oil) ; also 5 ml. vials	<i>Organon</i>
Theelin in Oil	1 ml. contains 1,000 I.U., 5,000 I.U., or 10,000 I.U. ..	<i>Parke, Davis</i>
Theelin Aqueous Suspension ..	Aqueous suspension containing 2 mg. (20,000 I.U.) in 1 ml.	<i>Parke, Davis</i>
Unden	1 ml. contains 1,000 I.U.	<i>Bayer</i>
OESTRONE MIXTURES		
Anteoivin Ampoules	Each ampoule contains anterior lobe pituitary hormone 100 I.U. and ovarian follicular hormone 50 I.U. ..	<i>Richter</i>
Anteoivin Tablets	Each tablet contains anterior lobe pituitary 3 grains and ovarian follicular hormone 15 I.U.	<i>Richter</i>
Climatone	Each tablet contains ovarian hormone, 200 I.U.; theobromine-calcium; calcium-lactium; nitroglycerin; and menthol valerian	<i>Paines & Byrne</i>
Glanditone-O Tablets	Each tablet contains ovarian hormone, 200 I.U.; pituitary whole gland, 1/20 grain; suprarenal, 1/20 grain; thyroid, 1/10 grain	<i>Richter</i>
Hormotone 'T' Tablets	Each enteric-coated tablet contains desiccated suprarenal and whole pituitary, 1/20 grain, and desiccated thyroid, 1/10 grain; ovarian follicular hormones therapeutically equivalent to 200 I.U.	<i>Carrnrick</i>
Menocrin Tablets	Each tablet contains ovarian gland, 3 grains; thyroid gland extract, 1/12 grain; anterior lobe pituitary, 4 grain; oestrone, 250 I.U... ..	<i>Endocrines-Spicer</i>
Ovarnon Tablets	Each tablet contains 150 mg. desiccated ovary with 10 I.U. oestrone	<i>Organon</i>

Panestrone

.. .. Each tablet contains ovarian hormone, 1,000 I.U., and desiccated suprarenal, pituitary, and ovarian substance, plus testes and thyroid

Paines & Byrne

OESTRONE PREPARATIONS**Kolpon Vaginal Bougies**

.. .. Each bougie contains 500 I.U.

Organon

Kolpon Vaginal Tablets

.. .. Each tablet contains 1,000 I.U.

Organon

Menformon Drops

.. .. 1 ml. contains 10,000 I.U. in oil

Organon

Menformon Ointment

.. .. 1 G. contains 5,000 I.U.

Organon

Menformon Suppositories

.. .. Each suppository contains 1,000 I.U. or 10,000 I.U.

Organon

Micryston

.. .. A microcrystalline suspension of oestrone in isotonic aqueous suspension, containing 2 mg. per ml. with 0.4% phenol; vials of 8 c.c.

Coates & Cooper

Oestrin Suppositories

.. .. Each suppository contains 1,000 I.U. or 5,000 I.U.

Paines & Byrne

Oestrosalve Ointment

.. .. 1 oz. contains 10,000 I.U.

Paines & Byrne

Oestrosalve Ointment, Conc.

.. .. 1 G. contains 2,500 I.U.

Paines & Byrne

Solestrin

.. .. 1 ml. contains 20,000 I.U.

Paines & Byrne

Unden Ointment

.. .. 1 G. contains 5,000 I.U.

Bayer

OESTRONE TABLETS**Glandubolin**

.. .. Each tablet contains 1,000 I.U. or 2,000 I.U.

Richter

Menformon

.. .. Each tablet contains 100 I.U., 500 I.U., 1,000 I.U., 3,000 I.U., 10,000 I.U., or 50,000 I.U.

Organon

Oestrin

.. .. Each tablet contains 1,000 I.U.

Oxo

Oestrone

.. .. Each tablet contains 1,000 I.U. or 10,000 I.U.

Hewlett

Progynon

.. .. Each tablet contains 1,000 I.U., 3,000 I.U., or 10,000 I.U.

British Schering

Unden Pellets

.. .. Each pellet contains 100 I.U., 500 I.U., or 1,000 I.U.

Bayer

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
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PANCREAS

Pancrex	Extract of pancreas for oral use or for injection in 1 ml. ampoules and 20 ml. vials	Paines & Byrne
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PARATHYROID HORMONE

Euparatone	5 ml. vials (20 Collip units per ml.)	Allen & Hanbury
Parathormone	5 ml. vials (100 units per ml.)	Lilly
Paroidin	5 ml. vials (100 units per ml.)	Parke, Davis
Parathyroid Hormone	5 ml. vials (20 Collip units per ml.)	Paines & Byrne

PITUITARY EXTRACTS

PITUITARY (ANTERIOR LOBE) ADRENOTROPHIC HORMONE

Cortrophin	Twin ampoules containing 5 or 10 Sudanophobic units	Organon
Pituitary Adrenotrophic Factor	5 ml. vials (10 adrenotrophic units per ml.)	Armour

PITUITARY (ANTERIOR LOBE) EXTRACT

Ambinon 'A'	Each ampoule contains 100 to 300 guinea-pig units thyrotrophic hormone, 50 rat units pituitary gonadotrophic hormone, with 100 rat units gonadotrophic hormone of pregnancy	Organon
Ambinon 'B'	Each ampoule contains 100 to 300 guinea-pig units thyrotrophic hormone with 50 units gonadotrophic hormone	Organon
Anterior Lobe Pituitary Extract	1 ml. ampoules	Parke, Davis
Antoxylin	$\frac{1}{2}$ ml. and 1 ml. ampoules and 10 ml. and 20 ml. vials (1 ml. = 2 grains of desiccated gland)	Oxo

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
Bioglan Natural Gonadotrophic Hormone	Each ampoule contains 100 or 500 rat units natural gonadotrophic hormone with solvent	<i>Bioglan</i>
Glanoid Thyrotrophic Factor	1 ml. contains 50 Collip units	<i>Armour</i>
Gonadotraphon	Each ampoule contains 50 or 200 mouse units, with solvent	<i>Paines & Byrne</i>
Luteoantin	Each suppository contains 100 rat units; each ampoule contains 100 or 400 rat units	<i>Richter</i>
Pitexan	Full hormone complement in capsule form	<i>Paines & Byrne</i>
Pituitary Anterior Lobe	1 ml. ampoules and 10 ml. and 20 ml. vials (1 ml. = 1½ grains of desiccated gland)	<i>Armour</i>
Pituitary Extract (Anterior Lobe)	1 ml. ampoules (= 1·2 G. fresh gland)	<i>Lilly</i>
Polyansyn	Each 5 ml. vial contains total hormone of anterior pituitary	<i>Armour</i>
Preloban	Each ampoule contains 25 maturation units, with solvent	<i>Bayer</i>
Synapoidin	A combination of the follicle-stimulating hormone from the anterior pituitary gland, and the luteinising hormone from human pregnancy urine. Supplied in 10 ml. vials each ml. containing 15 Synergy rat units	<i>Parke, Davis</i>
PITUITARY (ANTERIOR LOBE) GROWTH HORMONE		
Antuitrin—Growth	20 ml. vials (8 rat-growth units per ml.)	<i>Parke, Davis</i>
Pituitary (Anterior Lobe) Growth Complex	5 ml. vials (100 growth units per ml.)	<i>Armour</i>
PITUITARY (ANTERIOR LOBE) LACTOGENIC HORMONE		
Physolactin	15 ml. vials (60 Riddle-Bates units per ml.)	<i>Glaxo</i>
Prolactin	15 ml. vials (60 Riddle-Bates units per ml.)	<i>Allen & Hanbury</i>
Prolactin	5 ml. vials (100 Riddle-Bates units per ml.)	<i>Armour</i>

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
PITUITARY (ANTERIOR LOBE) THYROTROPIC HORMONE		
Pituitary (Anterior Lobe) Thyrotrophic Factor	.. 5 ml. vials (50 Thyrotrophic units per ml.) ..	Armour
PITUITARY (POSTERIOR LOBE) EXTRACT		
Glanduitrin	.. $\frac{1}{2}$ ml. and 1 ml. ampoules (10 I.U. per ml.) ..	Richter
Infundibulin	.. $\frac{1}{2}$ ml. and 1 ml. ampoules and 10 ml. and 25 ml. vials (10 I.U. per ml.); $\frac{1}{2}$ ml. ampoules (5 I.U. per ml.) ..	Evans Burrughs Wellcome Allen & Hanbury
Infundin	.. $\frac{1}{2}$ ml. and 1 ml. ampoules (10 I.U. per ml.) ..	Oxo
Pitibulin	.. 0.25 ml., 0.5 ml., and 1 ml. ampoules (10 I.U. per ml.) ..	Parke, Davis
Pitoxylon	.. $\frac{1}{2}$ ml. ampoules (5 I.U. per ml.), $\frac{1}{2}$ ml. and 1 ml. ampoules, and 10 ml. and 20 ml. vials (10 I.U. and 20 I.U. per ml.) ..	Boots
Pituitrin	.. $\frac{1}{2}$ ml. and 1 ml. ampoules (10 I.U. per ml.) ..	
Pituitary (posterior lobe) Extract	.. $\frac{1}{2}$ ml. and 1 ml. ampoules (10 I.U. per ml.) ..	
PITUITARY (POSTERIOR LOBE) EXTRACT AND ADRENALINE		
Adrenalin with Pitoxylon	.. 1 ml. ampoules and 10 ml. and 20 ml. vials (2 I.U. and 1 in 2,500 adrenaline per ml.) ..	Oxo
Infundrenalin	.. Twin ampoules containing 5 I.U. and $\frac{1}{2}$ ml. of 1 in 1,500 adrenaline solution.. ..	Evans
Pitalin	.. 1 ml. ampoules containing 5 I.U. and 0.5 mg. adrenaline ..	Paines & Byrne
Pitibulin and Adrenalin	.. Ampoules containing 2 $\frac{1}{2}$ units and adrenaline 1/200 grain ..	Allen & Hanbury
Pitoxylon with Adrenalin	.. 1 ml. ampoules and 10 ml. and 20 ml. vials (10 I.U. and 1 in 2,000 adrenaline per ml.) ..	Oxo
Pitrenalin	.. Twin ampoules containing 5 I.U. and 0.36 ml. of 1 in 1,000 adrenaline solution ..	Parke, Davis

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
PITUITARY (POSTERIOR LOBE) OXYTOCIC PRINCIPLE		
Pitocin	.. ½ ml. and 1 ml. ampoules (10 I.U. per ml.) ..	Parke, Davis
PITUITARY (POSTERIOR LOBE) PRESSOR PRINCIPLE		
Pitressin	.. ½ ml. and 1 ml. ampoules (20 pressor units per ml.) ..	Parke, Davis
PITUITARY SNUFFS		
Disipidin	.. In 100 grain bottles or in 1½ grain capsules ..	Paines & Byrne
Piton	.. 500 I.U. posterior pituitary extract per G. in 2 G. tubes ..	Organon
Pituitary Posterior Lobe Powder	.. In 1 G. phials ..	Richer
Pituitary Posterior Lobe Snuff	.. In 2/3 grain capsules ..	Armour
Pituitary Snuff	.. In powders, each sufficient for one insufflation ..	Endocrines-Spicer
STILBOESTROL AMPOULES		
Pabestrol	.. 1 ml. contains 1 mg. or 5 mg. ..	Paines & Byrne
Stilboestrol	.. 1 ml. contains 1 mg. or 5 mg. ..	Allen & Hanbury
Stilboestrol	.. 1 ml. contains 1 mg. or 5 mg. ..	Hewlett
Stilboestrol	.. 1 ml. contains 1 mg. or 5 mg. ..	Boots
Stilboestrol	.. 1 ml. contains 1 mg. or 5 mg. ..	British Drug Houses
Stilboestrol	.. 1 ml. contains 0.5 mg., 1 mg., or 5 mg. ..	Crookes
Stilboestrol	.. 1 ml. contains 1 mg. or 5 mg. ..	Evans
Stilboestrol	.. 1 ml. contains 5 mg. ..	Burroughs Wellcome
Stilboestrol	.. 1 ml. contains 1 mg. or 5 mg. ..	Oxo
Stilboestrol	.. 1 ml. contains 1 mg. or 5 mg. ..	Ward, Blenkinsop

STILBOESTROL DIPROPIONATE AMPOULES

Clinestrol	1 ml. contains 1 mg. or 5 mg.	Glaxo
Pabestrol 'D'	1 ml. contains 1 mg. or 5 mg.	Paines & Byrne
Stilboestrol Dipropionate	1 ml. contains 0.5 mg., 1 mg., or 5 mg.	Crookes
Stilboestrol Dipropionate	1 ml. contains 1 mg. or 5 mg.	Boots
Stilboestrol Dipropionate	1 ml. contains 1 mg. or 5 mg.	British Drug Houses
Stilboestrol Dipropionate	1 ml. contains 1 mg. or 5 mg.	Evans
Stilboestrol Dipropionate	1 ml. contains 1 mg. or 5 mg.	Organon
Syntestrin	1 ml. contains 1 mg. or 5 mg.	Richter

STILBOESTROL DIPROPIONATE TABLETS

Pabestrol 'D'	Each tablet contains 0.1 mg., 0.5 mg., 1 mg., or 5 mg. <i>Also enteric coated in 0.5 mg., 1 mg., or 5 mg.</i>	Paines & Byrne
Stilboestrol Dipropionate	Each tablet contains 0.1 mg., 1 mg., or 5 mg.	Crookes
Stilboestrol Dipropionate	Each tablet contains 0.1 mg., 0.5 mg., 1 mg., or 5 mg.	Boots
Stilboestrol Dipropionate	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	British Drug Houses
Stilboestrol Dipropionate	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	Evans
Permencyn Tablets	Each tablet contains 0.5 mg. or 1 mg.	Hough, Haseason
Syntestrin	Each tablet contains 0.1 mg., 0.25 mg., 0.5 mg., 1 mg., or 5 mg.	Richter

STILBOESTROL PREPARATIONS

Menopax	Each tablet contains 0.05 mg. stilboestrol dipropionate with Isobrom, Theobroma Pulv., Calcium Lactate, and Menthol. Menopax antipruritic cream containing Stilboestrol also available	Clinical Products
Pabestrosalbe	1 G. contains 2 mg.	Paines & Byrne
Stilboestrol Nasal Spray	1 ml. contains 0.1 mg.	Crookes

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
Stilboestrol Pessaries	Each pessary contains 0.25 mg.	Crookes
Stilboestrol Salve	1 G. contains 0.1 mg.	Crookes
Syntestrin Ointment	1 oz. contains 15 mg. stilboestrol dipropionate	Richier
Stilboestrol Ointment	1 gm. contains 10 mg.	Boots
Stilboestrol Ointment	Each G. contains $\frac{1}{2}$ mg. stilboestrol dipropionate	Burroughs Wellcome
STILBOESTROL TABLETS		
Clinestrol	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	Glaxo
Ovendosyn	Each tablet contains 0.5 mg. stilboestrol with calcium phosphate, 227 mg.	Menley & James
Ovendosyn-Forte	Each tablet contains 5 mg. stilboestrol with calcium phosphate, 325 mg.	Menley & James
Pabestrol	Each tablet contains 0.1 mg., 0.5 mg., 1 mg., or 5 mg. <i>Also enteric coated, 0.5 mg., 1 mg., or 5 mg.</i>	Paines & Byrne
Stilboestrol	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	Allen & Hanbury
Stilboestrol	Each tablet contains 0.1 mg., 0.5 mg., 1 mg., or 5 mg.	Boots
Stilboestrol	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	British Drug Houses
Stilboestrol	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	Evans
Stilboestrol	Each tablet contains 0.1 mg. (pink); 0.5 mg. (white); 1 mg. (yellow); 5 mg. (orange)	Hewlett
Stilboestrol	Each tablet contains 0.1 mg., 0.5 mg., 1 mg., or 5 mg.	Organon
Stilboestrol	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	Oxo
Stilboestrol	Each tablet contains 0.1 mg., 1 mg., or 5 mg.	Crookes
Stilboestrol	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	Burroughs Wellcome
Stilboestrol	Each tablet contains 0.5 mg., 1 mg., or 5 mg.	Ward, Blenkinsop

SUPRARENAL CORTEX EXTRACT

Cortigen	1 ml. ampoules and 10 ml. vials (4 cortico-dynamic units per ml.)	<i>Richter</i>
Eschatin	10 ml. vials (50 dog units per ml.)	<i>Parke, Davis</i>
Eucortone	10 ml. vials (1 ml. = 75 mg. Suprarenal cortex)	<i>Allen & Hanbury</i>
Supracort	1 ml. ampoules and 10 ml. vials (1 ml. = 75 G. gland)	<i>Paines & Byrne</i>
Suprarenal Cortex	1 ml. ampoules (1 ml. = 3 grains or 2.5 G. fresh gland) (<i>see also Deoxycorticosterone Acetate</i> , page 40)	<i>Armour</i>

TESTICULAR EXTRACT PREPARATIONS

Bitestin Ampoules	1 ml. ampoules of testicular extract, very rich in male sex hormone	<i>Richter</i>
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TESTOSTERONE and TESTOSTERONE PROPIONATE AMPOULES

Micryston	 A microcrystalline suspension of testosterone in isotonic aqueous suspension, containing 2 mg. per ml., with 0.4% phenol; vials of 8 ml.	<i>Coates & Cooper</i>
Neo-Hombreol	1 ml. contains 5 mg., 10 mg., or 25 mg.	<i>Organon</i>
Pantestin	1 ml. contains 5 mg., 10 mg., or 25 G.	<i>Richter</i>
	(<i>see also Methyl Testosterone</i> , page 43)	
Perandren	1 ml. contains 5 mg., 10 mg., or 25 mg. methyl testosterone and testosterone propionate	<i>Ciba</i>
Sterandryl	1 ml. contains 5 mg., 10 mg., or 25 mg.	<i>Roussel Labs.</i>
Testosterone Propionate	1 ml. contains 5 mg., 10 mg., or 25 mg.	<i>Boots</i>
Testosterone Propionate	1 ml. contains 1 mg., 5 mg., 10 mg., or 25 mg.	<i>Oxo</i>

<i>Name of Preparation</i>	<i>Description</i>	<i>Maker</i>
Testosterone Propionate	1 ml. contains 5 mg., 10 mg., or 25 mg. . .	British Drug Houses
Testosterone Propionate	1 ml. contains 5 mg., 10 mg., or 25 mg. . .	Burroughs Wellcome
Testoviron	1 ml. contains 5 mg., 10 mg., or 25 mg. . .	British Schering
Viormone	1 ml. contains 5 mg., 10 mg., or 25 mg. testosterone . .	Paines & Byrne

TESTOSTERONE and TESTOSTERONE PROPIONATE PREPARATIONS

Neo-Hombreol Ointment, Weak	1 G. contains 2 mg. testosterone propionate . .	Organon
Neo-Hombreol Ointment, Strong	1 G. contains 25 mg. testosterone propionate . .	Organon
Neo-Hombreol Suppositories	Each suppository contains 15 mg. testosterone propionate . .	Organon
Perandren Ointment	25 G. contains 50 mg. testosterone . .	Ciba
Sterandryl Implants	Implantation tablets of 100 mg. . .	Roussel Labs.
Testosterone	Implantation tablets of 100 mg. . .	Organon
Testosterone Propionate	Implantation tablets of 100 mg. . .	Organon
Testosterone Propionate	1 G. contains 25 mg. . .	Boots
Testoviron Ointment	25 G. containing 50 mg. testosterone, and 2 G. topicalators containing 4 mg. testosterone . .	British Schering
Viormone Salve	1½ oz. contains 90 mg. or 225 mg. . .	Paines & Byrne

THYROID

Elityran	Each tablet contains natural thyroid equivalent to approximately 0.15 mg. total organic iodine, and 0.09 mg. Thyroxine . .	Bayer
Paromin	Enteric-coated tablets equivalent to ½ grain thyroid, siccum, and 1 ml. ampoules each equivalent to 2 tablets . .	Paines & Byrne

Name of Preparation	Description	Maker
Thyranon	.. 5 mg., 10 mg., 25 mg., 50 mg., or 100 mg. desiccation per tablet	Organon Allen & Hanbury
Thyroidin Elixir	.. Each fluid drachm = 5 grains fresh gland Also issued by various manufacturers as Thyroid Tablets	
THYROXINE		
Thyroxine	.. 1 mg. and 0.3 mg. tablets; ampoules each containing 1 mg. in 1 ml.	British Schering British Drug Houses Burroughs Wellcome
Thyroxine	.. Oral tablets, 0.2 mg., 0.8 mg.; Hypodermic tablets, 1 mg.	
Thyroxine	.. 0.1 mg. and 1 mg.	

